210. Compressor 210 is shown in a refrigeration system which includes a condenser 350, a first expansion valve or throttle 352, a flash tank or an economizer 354, a second expansion valve or throttle 356, an evaporator 358 and a series of piping 360 interconnecting the components as shown in FIG. 14. Compressor 210 is operated by the motor to compress the refrigerant gas. The compressed gas is then liquified by condenser 350. The liquified refrigerant passes through expansion valve 352 and expands in flash tank 354 where it is separated into gas and liquid. The gaseous refrigerant further passes through piping 362 to be introduced into compressor 210 through fitting 310. On the other hand, the remaining liquid refrigerant further expands in expansion valve 356, is then vaporized in evaporator 358 and is again taken into compressor 210.

The incorporation of flash tank 354 and the remainder of the vapor injection system, allows the capacity of the compressor to increase above the fixed capacity of compressor 210. Typically, at standard air conditioning conditions, the capacity of the compressor can be increased by approximately 20% to provide a compressor with 120% of its capacity as shown in the graph in FIG. 16. In order to be able to control the capacity of compressor 210, a solenoid valve 364 is positioned within piping 362. The amount of percent increase in the capacity of compressor 210 can be controlled by operating solenoid valve 364 in a pulse width modulation mode. Solenoid valve 364 when operated in a pulse width modulation mode in combination with capacity control system 266 of compressor 210 allows the capacity of compressor 210 to be positioned anywhere along the line shown in FIG. 16.

FIG. 15 illustrates a refrigerant system schematic in accordance with another embodiment of the present invention. The refrigerant system shown in FIG. 15 is the same as the refrigerant system shown in FIG. 14 except that flash tank 354 has been replaced by a heat exchanger 354'. Compressor 210 is operated by the motor to compress the refrigerant gas. The compressed gas is then liquified by condenser 350. The liquified refrigerant is then routed to the liquid side of heat exchanger 354' while a second portion of the liquified refrigerant passes through expansion valve 352 and then is routed to the vapor side of heat exchanger 354' in a gas and liquid state. The portion of refrigerant passing through expansion valve 352 is heated by the portion of refrigerant passing directly through heat exchanger to provide the vapor for injecting into compressor 210. This gaseous refrigerant then passes through piping 362 to be introduced into compressor 210 through fitting 310. On the other hand, the liquid refrigerant passing directly through heat exchanger 354' expands in expansion valve 356 and is then vaporized in evaporator 358 to again be taken into the suction side of compressor 210. Similar to the system shown in FIG. 14, solenoid valve 364 is positioned within piping 362 to allow the capacity of compressor 210 to be positioned anywhere along the line shown in FIG. 16 when used in combination with capacity control system 266.

While the above detailed description describes the preferred embodiment of the present invention, it should be understood that the present invention is susceptible to modification, variation and alteration without deviating from the scope and fair meaning of the subjoined claims.

What is claimed is:

1. A scroll-type machine comprising:

a first scroll member having a first end plate and a first spiral wrap extending therefrom;

a second scroll member having a second end plate and a second spiral wrap extending therefrom, said first and second scroll members being positioned with said first and second spiral wraps interleaved with each other;

a drive member for causing said scroll members to orbit relative to one another whereby said spiral wraps will create pockets of progressively changing volume between a suction pressure zone and a discharge pressure zone;

said first and second scroll members being movable between a first relationship in which sealing surfaces of said first and second scroll members are in sealing relationship to close off said pockets and a second relationship wherein at least one of said sealing surfaces of said first and second scroll members are spaced apart to define a leakage path between said pockets; and

a fluid operated piston secured to said first scroll, said piston being actuatable to apply a force to said first scroll to move said first scroll between said first relationship where said scroll machine operates at substantially full capacity and said second relationship in which said scroll machine operates at substantially zero capacity.

2. The scroll-type machine according to claim 1, wherein said drive member continues to operate when said first scroll member is in said second relationship.

3. The scroll-type machine according to claim 2, wherein said scroll-type machine includes a discharge flow path for conducting compressed fluid from said scroll-type machine and a check valve located within said flow path to prevent reverse flow of said compressed fluid.

4. The scroll-type machine according to claim 1, wherein said fluid operated piston is operated in a time pulsed manner to modulate the capacity of said scroll-type machine.

5. The scroll-type machine according to claim 1, further comprising a fluid pressure chamber operative to apply said force to said fluid operated piston.

6. The scroll-type machine according to claim 5, wherein said force acts in an axial direction.

7. The scroll-type machine according to claim 6, further comprising a first passage for supplying a pressurized fluid from said scroll-type machine to said pressure chamber.

8. The scroll-type machine according to claim 7, further comprising a valve for controlling flow through said first passage, said valve being operative to vent said pressurized fluid from said pressure chamber to thereby enable said first and second scrolls to move between said first and second relationships.

9. The scroll-type machine according to claim 8, wherein said valve is a solenoid operated valve.

10. The scroll-type machine according to claim 9, wherein said solenoid operated valve is operated in a pulse width modulated mode.

11. The scroll-type machine according to claim 8, further comprising a control module in communication with said valve.

12. The scroll-type machine according to claim 11, further comprising at least one sensor in communication with said control module, said control module being operative to control said valve in response to a signal from said sensor.

13. The scroll-type machine according to claim 7, further comprising a second passage for venting said pressurized fluid from said pressure chamber.

14. The scroll-type machine according to claim 1, wherein said scroll-type machine includes a shell, said fluid operated piston being slidingly received within a fitting secured to said shell.

15. The scroll-type machine according to claim 14, wherein said piston and said fitting define a pressure chamber.

16. The scroll-type machine according to claim 15, wherein said pressure chamber is in communication with a suction chamber defined by said shell.

17. The scroll-type machine according to claim 16, further comprising a valve disposed between said pressure chamber and said suction chamber.

18. The scroll-type machine according to claim 17, wherein said valve is a solenoid valve.

19. The scroll-type machine according to claim 18, wherein said solenoid valve is operated in a pulse width modulated mode.

20. The scroll-type machine according to claim 17, wherein said pressure chamber is in communication with a discharge chamber defined by said shell.

21. The scroll-type machine according to claim 16, wherein said solenoid valve is operated in a pulse width modulated mode.

22. The scroll-type machine according to claim 21, further comprising a valve disposed between said pressure chamber and both said suction chamber and said discharge chamber.

23. The scroll-type machine according to claim 22, further comprising a valve disposed between said pressure chamber and said suction chamber.

24. The scroll-type machine according to claim 23, wherein said valve is a solenoid valve.

25. A scroll-type machine comprising:

a first scroll member having a first end plate and a first spiral wrap extending therefrom;

a second scroll member having a second end plate and a second spiral wrap extending therefrom, said first and second scroll members being positioned with said first and second spiral wraps interleaved with each other;

a drive member for causing said scroll members to orbit relative to one another whereby said spiral wraps will create pockets of progressively changing volume between a suction pressure zone and a discharge pressure zone;

said first and second scroll members being movable between a first relationship in which sealing surfaces of said first and second scroll members are in sealing relationship to close off said pockets and a second relationship wherein at least one of said sealing surfaces of said first and second scroll members are spaced apart to define a leakage path between said pockets;

a fluid operated piston secured to said first scroll and slidingly received within a bore defined by said shell, said piston being actuatable to apply a force to said first scroll to move said first scroll between said first relationship where said scroll machine operates at substantially full capacity and said second relationship in which said scroll machine operates at substantially zero capacity; and

a radially compliant sealing system disposed between said piston and said bore defined by said shell.

26. The scroll-type machine according to claim 25, further comprising an annular fitting disposed between said shell and said piston, said radially complaint sealing system being disposed between said piston and said fitting.

27. The scroll-type machine according to claim 25, wherein said radially complaint sealing system includes a lip seal.

28. The scroll-type machine according to claim 27, wherein said radially complaint sealing system includes a floating retainer.

29. The scroll-type machine according to claim 25, wherein said radially complaint sealing system includes a floating retainer.

30. A scroll-type machine comprising:

a first scroll member having a first end plate and a first spiral wrap extending from said first end plate;

a second scroll member having a second end plate and a second spiral wrap extending from said second end plate, said first and second scroll members being positioned with said first and second spiral wraps interleaved with each other;

a drive member for causing said scroll members to orbit relative to one another whereby said spiral wraps will create pockets of progressively changing volume between a suction pressure zone and a discharge pressure zone;

a mechanism for moving said first and second scroll members between a first relationship where sealing surfaces of said first and second scroll members are in sealing relationship to close off said pockets and a second relationship where at least one of said sealing surfaces of said first and second scroll members are spaced apart to define a leak path between said pockets; and

a fluid injection system associated with one of said scroll members for injecting a fluid into at least one of said pockets.

31. The scroll-type machine according to claim 30, wherein said mechanism is operated in a pulse width modulation mode.

32. The scroll-type machine according to claim 31, wherein said fluid being injected into said at least one of said pockets is a vapor.

33. The scroll-type machine according to claim 30, wherein said mechanism includes a solenoid valve.

34. The scroll-type machine according to claim 33, wherein said solenoid valve is operated in a pulse width modulation mode.

35. The scroll-type machine according to claim 30, wherein said mechanism includes a fluid operated piston secured to said first scroll, said piston being activatable to apply a force to said first scroll to move said first scroll between said first and second relationships.

36. The scroll-type machine according to claim 35, wherein said drive member continues to operate when said first scroll member is in said second relationship.

37. The scroll-type machine according to claim 35, wherein said fluid operated piston is operated in a time pulsed manner to modulate the capacity of said scroll-type machine.

38. The scroll-type machine according to claim 37, wherein said fluid injection system includes a solenoid valve for controlling flow of said fluid to said one of said scroll members.

39. The scroll-type machine according to claim 38, wherein said solenoid valve is operated in a pulse width modulation mode.

40. The scroll-type machine according to claim 39, wherein said fluid being injected into one of said pockets is a vapor.

41. The scroll-type machine according to claim 35, wherein said fluid being injected into said at least one of said pockets is a vapor.

42. The scroll-type machine according to claim 30, wherein said fluid injection system includes a solenoid valve for controlling flow of said fluid to said one of said scroll members.

43. The scroll-type machine according to claim 42, wherein said solenoid valve is operated in a pulse width modulation mode.

44. The scroll-type machine according to claim 43, wherein said fluid being injected into one of said pockets is a vapor.

45. A scroll-type machine comprising:

a first scroll member having a first end plate and a first spiral wrap extending from said first end plate;

a second scroll member having a second end plate and a second spiral wrap extending from said second end plate, said first and second scroll members being positioned with said first and second spiral wraps interleaved with each other;

a drive member for causing said scroll members to orbit relative to one another whereby said spiral wraps will create pockets of progressively changing volume between a suction pressure zone and a discharge pressure zone; and

a vapor injection system associated with one of said scroll members for injecting a vapor into at least one of said pockets, said vapor injection system including a valve for controlling said vapor being injected into said at least one of said pockets.

46. The scroll-type machine according to claim 45, wherein said valve is a solenoid valve.

47. The scroll-type machine according to claim 46, wherein said solenoid valve is operated in a pulse width modulation mode.

48. The scroll-type machine according to claim 47, wherein said fluid being injected into one of said pockets is a vapor.

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